Claims

1. A heterogeneous ruthenium catalyst comprising silicon dioxide as support material, wherein the catalyst surface comprises alkaline earth metal ions (M^{2+}).

2. The ruthenium catalyst according to claim 1, wherein the catalyst surface comprises magnesium ions (Mg^{2+}).

3. The ruthenium catalyst according to claim 1 or 2, wherein the catalyst comprises from 0.1 to 10% by weight of ruthenium and the catalyst surface comprises from 0.01 to 1% by weight of the alkaline earth metal ion(s) (M^{2+}), in each case based on the weight of the silicon dioxide support material.

4. The ruthenium catalyst according to claim 1 or 2, wherein the catalyst comprises from 0.2 to 5% by weight of ruthenium and the catalyst surface comprises from 0.05 to 0.5% by weight of the alkaline earth metal ion(s) (M^{2+}), in each case based on the weight of the silicon dioxide support material.

5. The ruthenium catalyst according to any of the preceding claims, wherein the catalyst is produced by single or multiple impregnation of the support material with a solution of a ruthenium(III) salt, drying and reduction.

6. The ruthenium catalyst according to any of the preceding claims, wherein the alkaline earth metal ions (M^{2+}) are introduced into the catalyst surface by impregnating a preliminary heterogeneous ruthenium catalyst with a solution of an alkaline earth metal(II) salt.

7. The ruthenium catalyst according to the preceding claim, wherein the solution of an alkaline earth metal(II) salt is an aqueous solution of magnesium nitrate or calcium nitrate.

8. The ruthenium catalyst according to any of the preceding claims, wherein the support material based on amorphous silicon dioxide has a BET surface area (in accordance with DIN 66131) in the range from 30 to 700 m^2/g.

9. The ruthenium catalyst according to any of the preceding claims, wherein the catalyst comprises less than 0.05% by weight of halide (determined by ion chromatography), based on the total weight of the catalyst.

10. The ruthenium catalyst according to any of the preceding claims, wherein the ruthenium is concentrated as a shell at the catalyst surface.

11. The ruthenium catalyst according to the preceding claim, wherein the ruthenium in the shell is partially or fully crystalline.

12. The ruthenium catalyst according to any of the preceding claims, wherein the alkaline earth metal ion(s) is/are highly dispersed in the catalyst surface.

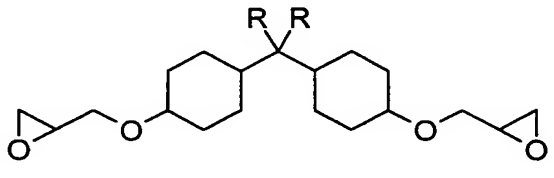
13. The heterogeneous ruthenium catalyst according to any of the preceding claims, wherein the percentage ratio of the signal intensities of the Q_2 and Q_3 structures Q_2/Q_3 in the silicon dioxide support material determined by means of solid-state ^{29}Si-NMR is less than 25.

14. The ruthenium catalyst according to any of the preceding claims, wherein the total concentration of Al(III) and Fe(II and/or III) in the silicon dioxide support material is less than 300 ppm by weight.

15. A process for hydrogenating a carbocyclic aromatic group to form the corresponding carbocyclic aliphatic group, wherein a heterogeneous ruthenium catalyst according to any of claims 1 to 14 is used.

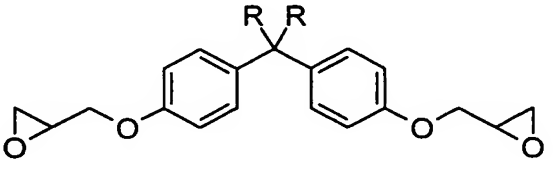
16. The process according to the preceding claim for hydrogenating a benzene ring to form the corresponding carbocyclic 6-membered ring.

17. The process as claimed in either of the two preceding claims for preparing a bisglycidyl ether of the formula I



(I),

where R is CH_3 or H, by ring hydrogenation of the corresponding aromatic bisglycidyl ether of the formula II



(II).

18. The process according to claim 17, wherein the aromatic bisglycidyl ether of the formula II which is used has a content of corresponding oligomeric bisglycidyl ethers of less than 10% by weight.

19. The process according to claim 17, wherein the aromatic bisglycidyl ether of the formula II which is used has a content of corresponding oligomeric bisglycidyl ethers of less than 5% by weight.

20. The process according to either of the two preceding claims, wherein the oligomeric bisglycidyl ethers have a molecular weight in the range from 568 to 1338 g/mol for R = H and a molecular weight in the range from 624 to 1478 g/mol for R = CH_3.

21. The process according to any of claims 15 to 20, wherein the hydrogenation is carried out at a temperature in the range from 30 to 200°C.

22. The process according to any of claims 15 to 21, wherein the hydrogenation is carried out at absolute hydrogen pressures in the range from 10 to 325 bar.

23. The process according to any of claims 15 to 22, wherein the hydrogenation is carried out over a fixed bed of catalyst.

24. The process according to any of claims 15 to 22, wherein the hydrogenation is carried out in a liquid phase in which the catalyst is comprised in the form of a suspension.

25. The process according to any of claims 17 to 24, wherein the aromatic bisglycidyl ether of the formula II is used as a solution in an organic solvent which is inert toward the hydrogenation with the solution comprising from 0.1 to 10% by weight, based on the solvent, of water.

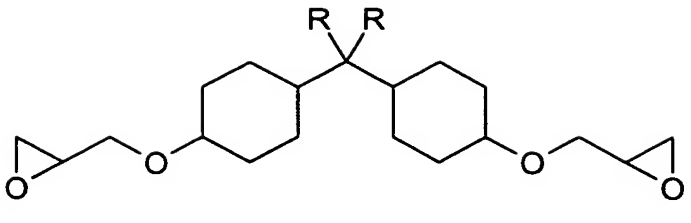
26. The process according to any of claims 15 to 25, wherein a solution of the substrate to be hydrogenated which comprises alkali earth metal ions (M^{2+}) is used.

27. The process according to any of claims 15 to 25, wherein a solution of the substrate to be hydrogenated which comprises magnesium ions (Mg^{2+}) is used.

28. The process according to either of the two preceding claims, wherein the alkaline earth metal ion content of the solution is from 1 to 100 ppm by weight.

29. The process according to claim 26 or 27, wherein the alkaline earth metal ion content of the solution is from 2 to 10 ppm by weight.

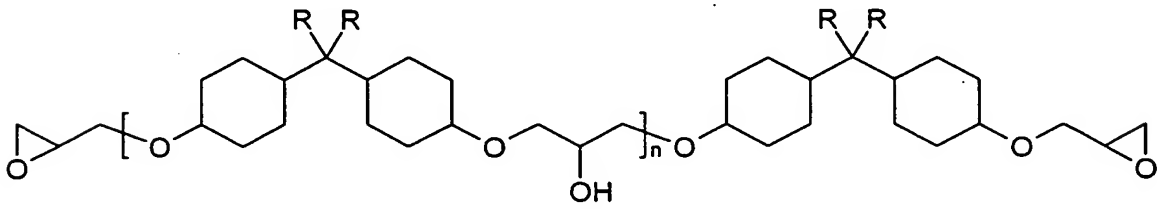
30. A bisglycidyl ether of the formula I



(I),

where R is CH_3 or H, which can be prepared by a process according to any of claims 15 to 29.

31. The bisglycidyl ether according to the preceding claim which has a content of corresponding oligomeric ring-hydrogenated bisglycidyl ethers of the formula



where n = 1, 2, 3 or 4, of less than 10% by weight.

32. The bisglycidyl ether according to the preceding claim which has a content of corresponding oligomeric ring-hydrogenated bisglycidyl ethers of less than 5% by weight.

33. The bisglycidyl ether according to claim 31 which has a content of corresponding oligomeric ring-hydrogenated bisglycidyl ethers of less than 1.5% by weight.

34. The bisglycidyl ether according to claim 31 which has a content of corresponding oligomeric ring-hydrogenated bisglycidyl ethers of less than 0.5% by weight.

35. The bisglycidyl ether according to any of claims 31 to 34, wherein the content of oligomeric ring-hydrogenated bisglycidyl ethers is determined by heating the aromatic bisglycidyl ether for 2 hours at 200°C and for a further 2 hours at 300°C, in each case at 3 mbar.

36. The bisglycidyl ether according to any of claims 31 to 34, wherein the content of oligomeric ring-hydrogenated bisglycidyl ethers is determined by GPC measurement (gel permeation chromatography).

37. The bisglycidyl ether according to the preceding claim, wherein the content of oligomeric bisglycidyl ethers in % by area determined by GPC measurement is equated to a content in % by weight.

38. The bisglycidyl ether according to any of claims 30 to 37 which has a total chlorine content determined in accordance with DIN 51408 of less than 1000 ppm by weight.

39. The bisglycidyl ether according to any of claims 30 to 38 which has a ruthenium content determined by mass spectrometry in combination with inductively coupled plasma (ICP-MS) of less than 0.3 ppm by weight.

40. The bisglycidyl ether according to any of claims 30 to 39 which has a platinum-cobalt color number (APHA color number) determined in accordance with DIN ISO 6271 of less than 30.

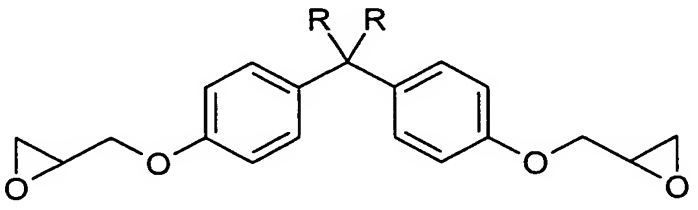
41. The bisglycidyl ether according to any of claims 30 to 40 which has an epoxy equivalent weight determined in accordance with the standard ASTM-D-1652-88 in the range from 170 to 240 g/equivalent.

42. The bisglycidyl ether according to any of claims 30 to 41 which has a proportion of hydrolyzable chlorine determined in accordance with DIN 53188 of less than 500 ppm by weight.

43. The bisglycidyl ether according to any of claims 30 to 42 which has a kinematic viscosity determined in accordance with DIN 51562 of less than 800 mm^2/s at 25°C.

44. The bisglycidyl ether according to any of claims 30 to 43 which has a cis-cis:cis-trans:trans-trans isomer ratio in the range 44-63%:34-53%:3-22 %.

45. The bisglycidyl ether according to any of claims 30 to 44 obtained by complete hydrogenation of the aromatic rings of a bisglycidyl ether of the formula II



(II),

where R is CH_3 or H, with the degree of hydrogenation being > 98%.